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The California Olive Industry: Economic Environment, 1969

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THE CALIFORNIA OLIVE INDUSTRY: ECONOMIC ENVIRONMENT, 1969

by

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FOREWORD

Undergraduate students in Agricultural Economics and Agricultural Business Management at the University of California at Davis are required to complete a two-quarter course in individual research prior to graduation. The purpose of the requirement is to give each student an opportunity to conduct an investigation of a problem in agricultural economics, making use of the theoretical and technical tools of analysis acquired during his undergraduate years. Under the guidance of an experienced professor, the students are introduced to processes of investigation of economic and social problems and to use the library and other supporting research facilities. The results of their investigations are evaluated critically during the entire course. The final product of this effort is a research report, prepared by the student and corrected as many times as is necessary to insure accuracy of content and correctness of expression.

The California Olive Industry: Economic Environment, 1969, by Mr. Don Roark, was prepared in Agricultural Economics 190A-B during 1968-1969 under the general supervision of Professor J. Herbert Snyder. As the study progressed, Mr. Roark consulted extensively with Professors Jerry Foytik and Gordon King, regarding techniques of analysis and accuracy of content of the paper. At the conclusion of the study, the instructor submitted the paper to the publications advisory committee of the Giannini Foundation of Agricultural Economics to be appraised with regard to possible publication of the study. Several suggestions were made at that time which have subsequently been incorporated into the paper. Additional improvements in the paper have been made by Mr. Roark based on suggestions received from Professor Richard King and Dr. Jerry Siebert. The final product is being published as a service to the agricultural industry of California as an outstanding example of classroom effort that benefits not only students but also the citizens of California.

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THE CALIFORNIA OLIVE INDUSTRY: ECONOMIC ENVIRONMENT, 1969

by

Don Roark*

I. INTRODUCTION

Nearly ten years have passed since an economic report dealing with the California olive industry has been published [12]. During this period the industry has experienced a number of significant changes--at the processor level, changes have concerned the consolidation of processing firms; from a production standpoint, there has been a recent decline in bearing olive acreage; and for the growers, there has been three consecutive years of above average prices.

Objectives

With conditions of uncertainty within the industry, there is a constant need of empirical tools useful for decision making. The objective of this study is to analyze the important economic aspects of the California olive industry. This analysis can provide analytical and descriptive information that is useful for decision-making processes. The quantitative relationships and the statistical models that are developed can be used for investment decisions, annual price estimation, and evaluation of changes in institutional factors such as tariffs and marketing orders.

Framework for Analysis

An economic model of the California olive industry is diagrammed in Figure I-1. Each of the various economic and physical forces directly or indirectly influence several of the remaining sectors of the industry.

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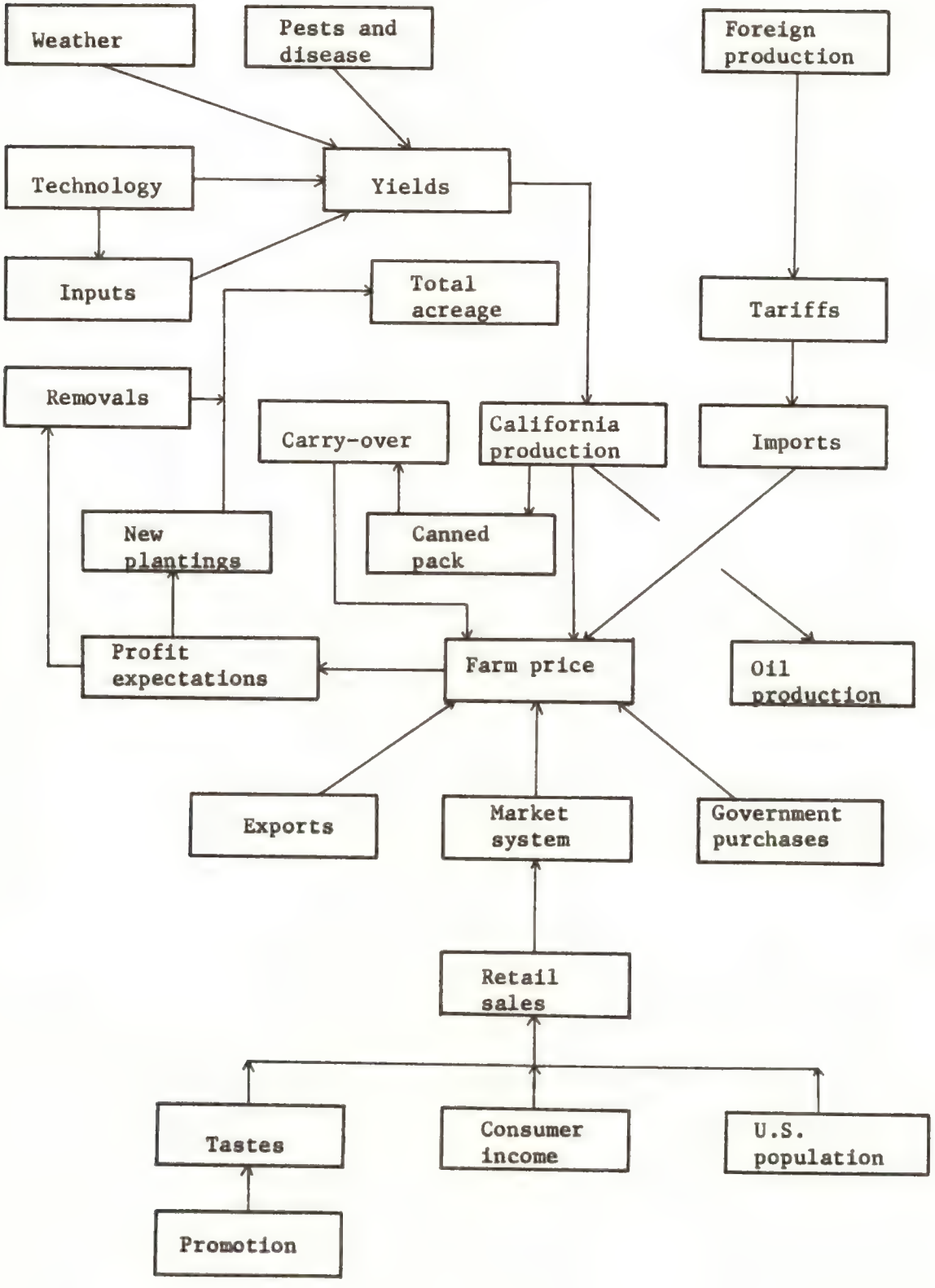
FIGURE I-1

A Diagrammed Representation of the California Olive Industry



For simplicity, this graphical representation can be subdivided into three basic divisions. The demand for olives is described by the lower one-half of the graph. Production factors are included in the upper left-hand corner, and supply determinants dominate the remainder. These three divisions shall serve as the basic framework for analysis.

In Part II, some of the basic elements of olive production are considered. An overview of the industry is presented--including information on cultural methods, production trends, and some of the institutional factors of the industry. The purpose of Part II is to provide background for further analysis.

Part III considers some of the determinants of olive supply. It describes changes in olive acreage, California supply, and the supply of imported olives over time.

The lower portion of Figure I-1 is examined in Part IV. Here the concept of derived demand is discussed to show the relationship between consumer demand and farm price. The effect of supply and other factors upon price is studied.

Part V illustrates one application for the analytical results by using quantitative relationships to form a statistical model of the industry. This model is used to project acreage, supply, and prices to 1980.

II. OVERVIEW OF THE OLIVE INDUSTRY

The history of olive culture dates back to about 3,000 B.C. with records of olive growing in the areas surrounding the Mediterranean Sea. The presence of olive trees in California goes back to the earliest Spanish mission settlements [6, p. 229]. Olive production in California was of minor importance until the early 1900's. The development of the canned table olive market caused the evolution of the total olive industry to its present status.

Olive Culture[1/]

The olive tree (Olea europaea) is a perennial subtropical crop. The tree thrives in warm to hot summers and will freeze at temperatures below 10° to 13° F.

Olive trees are propagated by cuttings, budding, and grafting. Following planting, it will usually take five to seven years for the tree to produce significant yields. The productive life of the tree often exceeds 50 years.

In California, olive fruit set occurs in May with harvesting (dependent upon weather and variety) done the following September to November. A certain amount of winter chilling is necessary for successful fruit set.

Olive trees in California receive fairly intensive cultivation. Almost all are grown under irrigation; and fertilization, pruning, and pest control practices are necessary for profitable yields.

Verticillium, a fungus disease attacking olive tree roots, is the major pest and disease problem facing olive growers today. There is no proven means for preventing or controlling this disease.

Varieties

There are three major olive varieties grown in California. They are: Manzanillo, Sevillano, and Mission. A summary of the essential characteristics of these three varieties is given below [15].

Manzanillo: Fruit matures before fall frosts; fair value for oil; chief use is for processed table olives; medium in size; relatively low, easy to harvest trees.

Sevillano: Large-sized fruit used mainly for canning; receives a premium price due to size; little value for oil use.

Mission: Similar in size to Manzanillo; high oil content; matures late; not well suited for table olive processing, which is major reason for its relative decline in recent years.

1/ Material in this section is based largely upon Chandler [6] and Hartmann and Opitz [15].

Production Areas

California olive production represents nearly 100 percent of the total U.S. olive production. Processor availability and historical location trends are reasons for its absence from other areas with suitable climates.

Total olive production in the United States represents less than 1 percent of the world supply. Table II-1 shows world olive production in 1966. The area surrounding the Mediterranean Sea still retains its stature as the main olive-growing region of the world. The bulk of foreign olive production is crushed for oil use.

Within California there are two main olive-growing areas. One area is the Central San Joaquin Valley district, centered in Tulare County; the second is the Northern Sacramento Valley area, centered in Butte and Tehama counties. A third production area that has declined in importance in recent years is Southern California. Increased urbanization is largely responsible for the acreage decline in this area. Olive acreage is found in almost all counties in California where the climate is suitable for olive culture.

Figure II-1 outlines the 1968 distribution of California olive acreage. Figure II-2 graphs the trends in major California production areas from 1930 to 1968.

Production Trends

Yield per bearing acre is the most variable component of olive production. In a study of 19 California fruit and nut crops, olives exhibited the highest variation in annual yields [5, p. 183]. The olive tree's alternate bearing characteristic is the primary reason for yield fluctuations. This means a light crop year will be followed by a heavy crop year, and vice versa. Olive yields over time are plotted in the lower portion of Figure II-3.

Contrary to yields, olive acreage has remained relatively constant since the 1930's. Bearing acreage has fluctuated between 26,000 and 29,000 acres. Nonbearing acreage has ranged from less than 1,000 acres in the late 1930's to over 5,000 acres in the late 1940's. Bearing and nonbearing olive acreage is shown in the upper two portions of Figure II-3.

TABLE II-1

World Olive Production, 1966

Area	Production	Total world production
	1,000 metric tons	percent
Albania	52	
France	5	
Greece	970	
Italy	1,802	
Spain	2,224	
Portugal	219	
Yugoslavia	30	
All Europe	5,302	75.52
Mexico	5	
United States	53	
All North America	58	.83
Argentina	49	
Brazil	1	
Chile	20	
Peru	9	
All South America	71	1.01
Nationalist China	2	
Cyprus	17	
Iran	15	
Iraq	9	
Israel	11	
Jordan	33	
Lebanon	29	
Syria	116	
Turkey	841	
All Mid-East and Asia	1,073	15.28
Algeria	140	
Tripoli	100	
Morocco	135	
Tunisia	120	
United Arab Republic	12	
All North Africa	507	7.22
Australia	2	.02
Total world production	7,021	

Source: Food and Agriculture Organization of the United Nations [9].

FIGURE II-1

Distribution of California Olive Acreage, 1966

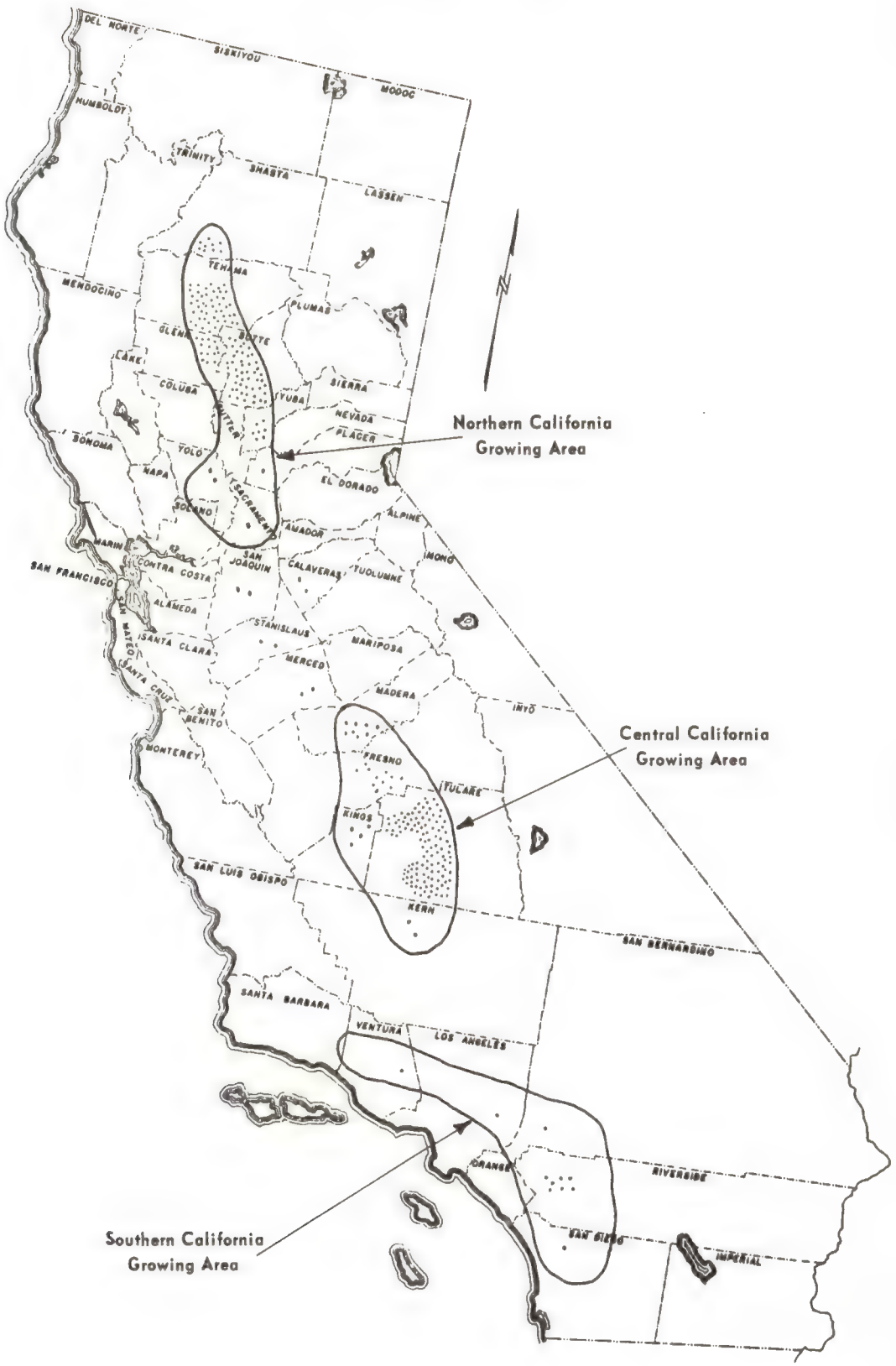
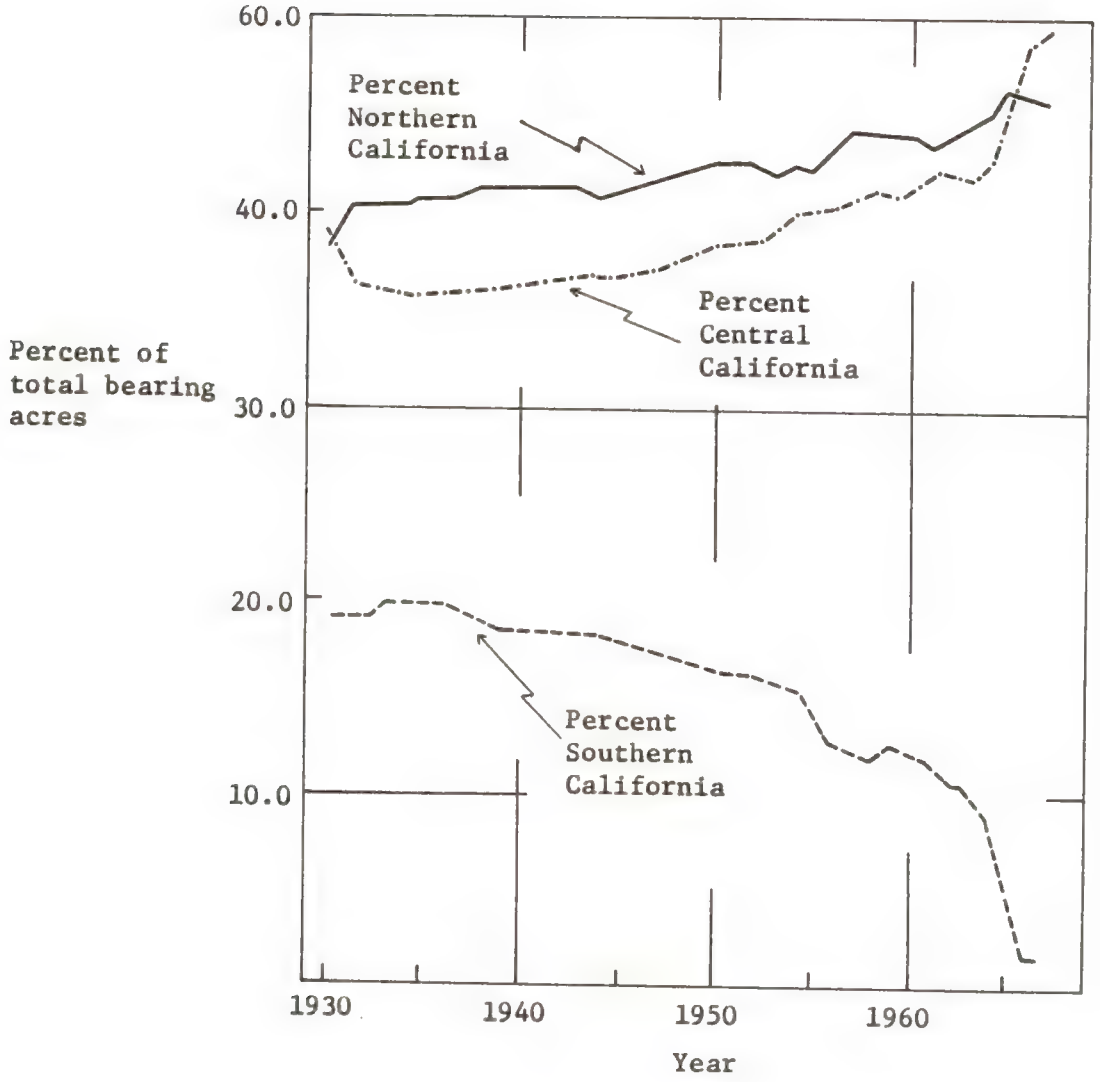


FIGURE II-2

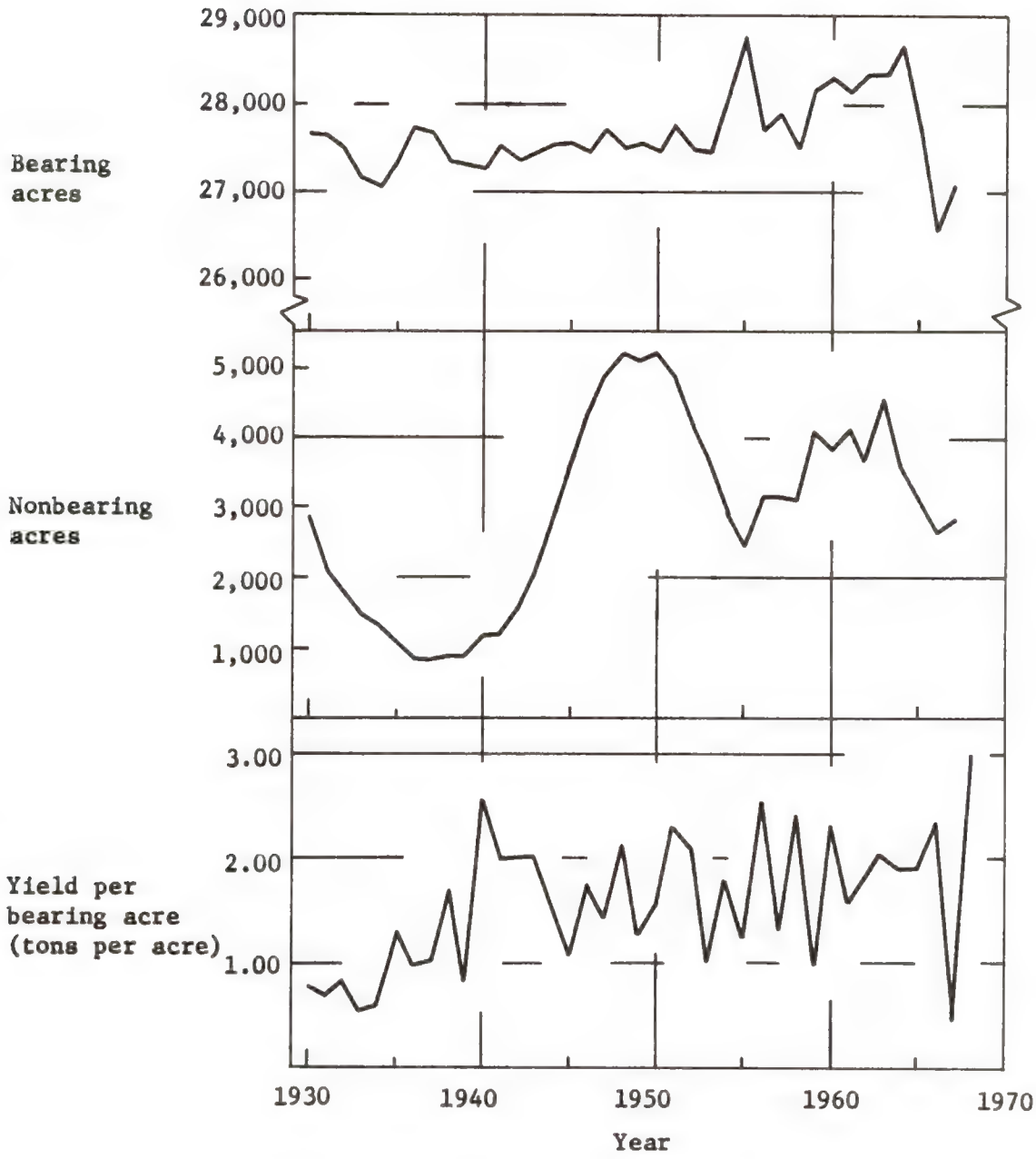
Regional Distribution of Total California
Bearing Olive Acreage, 1930 to 1967



Source: California Department of Agriculture, Crop and Livestock Reporting Service [2].

FIGURE II-3

California Olive Yields, Bearing Acreage, and Nonbearing Acreage, 1930 to 1968



Source: California Department of Agriculture, Crop and Livestock Reporting Service [3].

Use of Olive Fruit

Until the twentieth century, the main use for olives was crushing for oil. The development of a curing process in the early 1900's opened the market for canned and bottled processed olives [16, p. 17]. The continued expansion of the table olive market has resulted in an increased proportion of olives being canned. The canned olive growth has been accompanied by a decline in the share of olives crushed for oil. The allocation of California olives among various uses is pictured in Figure II-4. "Other" uses included in this diagram are farm consumption, fresh shipments, dried olives, and specialty types of cured table olives.

Processor Structure

In 1953 there were about 30 processors of canned olives in California [14, p. 4]. This number stood at 29 in 1959 [24, p. 77], dropped to 14 by 1966 [15, p. 6], and was reduced to 11 by the 1968 season. The trend to fewer firms has been accomplished by mergers and purchases within the industry. This reordering of firms has given most processors a larger share of the total canned olive market.

In 1968 three cooperative firms marketed approximately 56 percent of the harvested crop. The largest single firm, a cooperative, marketed about 41 percent of this crop. The three next largest firms marketed an additional 36 percent. The remaining seven processors accounted for about 23 percent of the 1968 harvested crop.

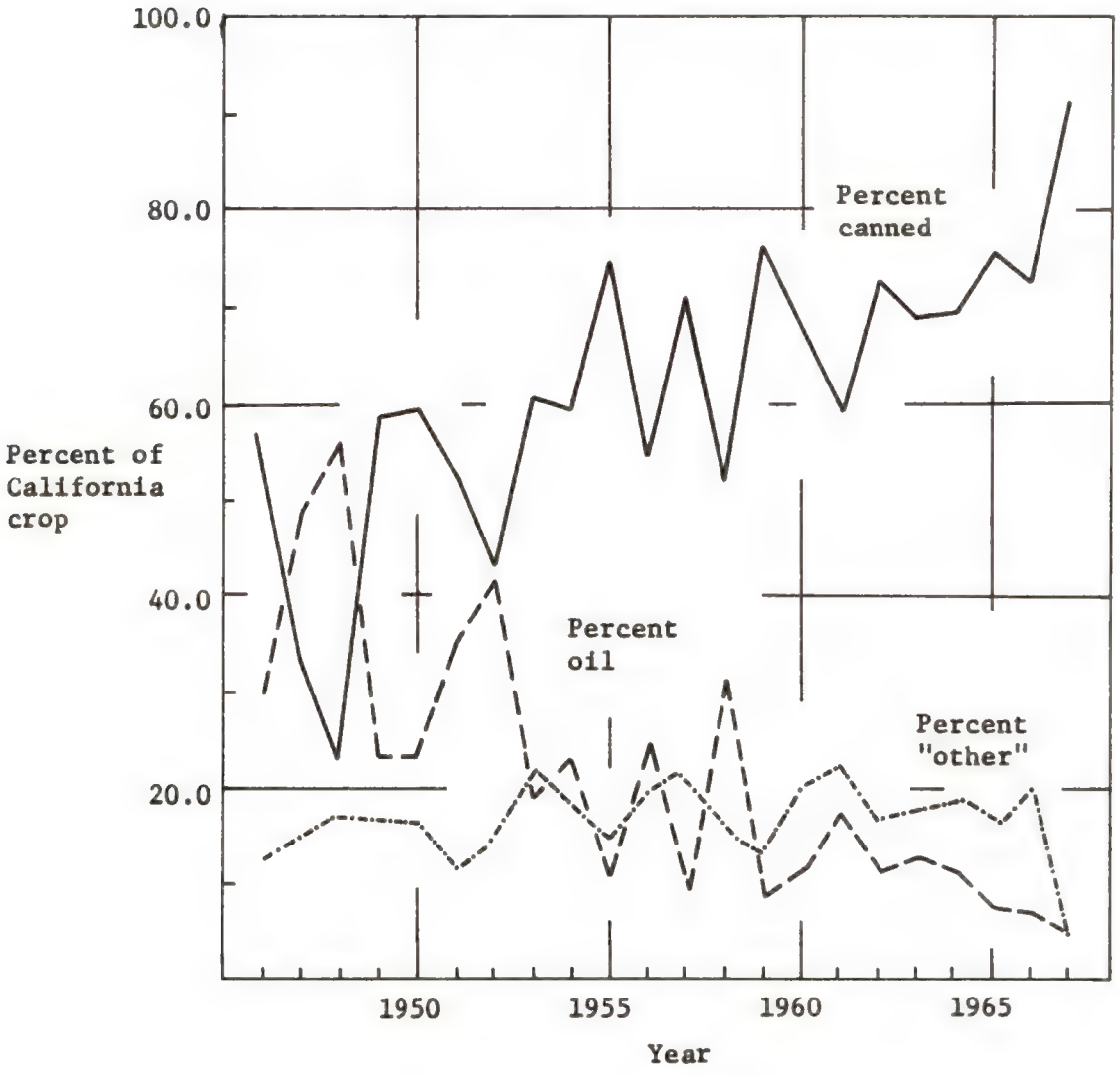
III. DETERMINANTS OF OLIVE SUPPLY

A summary of olive supply in the United States from 1947 to 1968 is depicted in Table III-1. The total supply of olives available for marketing consists of California production, imports of processed olives, and carry-over of canned olives from the previous season. This total supply is allocated to various uses: table olive sales, oil sales, "other" sales, and end-of-season carry-over.

Each of the sources of supply will be discussed to indicate quantitative methods of estimating supply in any given year.

FIGURE II-4

Relative Use of California Olive Production,
1946 to 1967



Source: California Department of Agriculture, Crop and Livestock Reporting Service [3].

TABLE III-1

Sources and Disposition of U.S. Supply of Olives, 1947 to 1968

Year	Supply				Disposition			
	Beginning carry-over[a]	California production[b]	Imports of table olives[a/c]	Total supply	Table olives[a]	Oil[b]	"Other"[b/d]	Ending carry-over[a]
	1,000 tons							
1947	6.6	39.8	23.3	69.7	40.2	19.4	6.7	3.4
1948	3.4	57.8	28.0	89.2	45.1	33.6	10.7	- 0.2
1949	- 0.2	34.8	26.9	61.5	47.5	7.9	6.5	- 0.4
1950	- 0.4	41.8	35.7	77.1	58.1	9.7	7.2	2.1
1951	2.1	63.8	30.3	96.2	56.1	22.4	8.1	9.6
1952	9.6	56.8	43.1	109.5	71.3	23.4	9.0	5.8
1953	5.8	27.8	33.5	67.1	54.7	5.2	5.7	1.5
1954	1.5	49.8	34.7	86.0	63.0	11.5	8.9	2.6
1955	2.6	35.8	37.6	76.0	65.1	3.9	5.2	1.8
1956	1.8	69.8	28.4	100.0	59.4	17.8	13.8	9.0
1957	9.0	36.8	33.1	78.9	60.2	3.1	7.8	7.8
1958	7.8	65.8	36.6	110.2	68.9	21.3	10.7	9.3
1959	9.3	26.8	39.6	75.7	65.5	2.3	4.1	3.8
1960	3.8	65.8	40.9	110.5	79.0	7.8	13.7	10.0
1961	10.0	43.8	43.2	97.0	72.6	7.8	9.9	6.7
1962	6.7	51.8	32.7	91.2	66.3	5.7	8.4	10.8
1963	10.8	56.8	38.9	106.5	75.7	7.5	10.2	13.1
1964	13.1	53.8	41.7	108.6	86.9	6.2	10.1	5.4
1965	5.4	49.8	34.5	89.7	73.7	3.8	8.2	4.0
1966	4.0	62.8	42.1	108.9	81.6	4.8	12.5	10.0
1967	10.0	12.0	34.9	56.9	53.9	0.5	0.5	2.0
1968	2.0	81.0	41.1	124.1	107.0[e]	2.0[e]	10.0[e]	--[f]

a/ California Olive Association [4].

b/ California Department of Agriculture, Crop and Livestock Reporting Service [3].

c/ Year ending June 30.

d/ Includes chopped, sliced, halved canned olives, Sicilian type, Greek type, fresh, and farm consumption.

e/ Preliminary estimates [3].

f/ Data not available.

California Supply

For any season, the total California production of olives can be described by the relationship

$$Q_t = (BA_t)\ (Y_t) \tag{1}$$

where

Q_t = annual California olive production,

BA_t = California bearing acreage of olive trees, and

Y_t = average yield per bearing acre of California olive trees.

This total production will be allocated among canning, crushing for oil, and "other" uses. The quantity of unsold canned olives at the end of the season is the carry-over supply.

California seasonal supply is determined by the characteristics of yield, acreage, use, and carry-over.

Acreage

Bearing acreage of olive trees is a long-term variable described by the relationship

$$BA_t = BA_{t-1} + NP_{t-7} - R_{t-1} \tag{2}$$

where

BA_t = bearing acreage of olive trees,

BA_{t-1} = bearing acreage of olive trees in the previous season,

NP_{t-7} = new plantings of olive trees made seven years previously, and

R_{t-1} = removal of bearing olive acreage in previous season.

New Plantings

The relationship between new acreage of a perennial crop with other variables is described by French and Bressler [8] in a study of lemon acreage response. They state, "The acreage of new lemon trees planted in any given

year depends on the long-run profitability of growing lemons, the age distribution of existing trees, the expected profitability of existing enterprises, and the combined effect of other minor factors." [8, p. 1023].

These authors then describe the methods and results of quantifying lemon acreage response. The end result is a linear function where new plantings vary according to the past grower returns.

The method used to estimate olive acreage response (new plantings) is similar to the one developed by the above authors. It assumes growers base their future expectations on returns received in the past.

An estimate of new plantings of olive trees is given by the equation

$$NP_t = -512.7 + \underset{(4.05)}{3.4409}\ \bar{P}_{t-1} \qquad (3)$$

$$R^2 = .7371 \qquad S.E. = 104$$

where

NP_t = acres of new olive trees planted and

$\bar{P}_{t-1}$ = three-year weighted average of gross olive returns per acre deflated by the Wholesale Price Index (1957-1959 = 100).

The value in parentheses is the t-ratio for the regression coefficient. The coefficient of determination, R^2, indicates 73 percent of the variation in new plantings is explained by variation in the independent variable. S.E. is the standard error of estimate for NP_t.

Other independent variables considered, but found insignificant, were: undeflated grower returns, returns from canning use only, net grower returns over both three- and five-year periods, and measures of profitability of other fruit crops.

Removals

Data for removals of olive trees are not available. A rough estimate of removals can be made by analyzing changes in new plantings and bearing acreage over time. An estimate, using data from 1947 to 1968, indicates an average annual removal of olive trees equal to 1.5 to 2.0 percent of the bearing acreage. This estimate is consistent with the tree's life of 50 or more years.

Yields

In Part II it was mentioned California olive yields are highly variable due to the alternate bearing habit of the olive tree. Weather, disease, and pests are other factors that can influence yields in any given season.

Using time-series data, olive yields can be estimated by the equation

$$Y\ Y_t = 2.73309 - \underset{(-4.56)}{.77939}\ Y_{t-1} + \underset{(1.78)}{.38236}\ \text{Log}\ T \qquad (4)$$

$$R^2 = .5164 \qquad \text{S.E.} = .4287$$

where

Y_t = olive yield per bearing acre in tons;

Y_{t-1} = olive yield per bearing acre of previous year in tons; and

T = time trend wih 1947 = 1, 1948 = 2, . . ., 1968 = 22.

The t-ratios in parentheses for Y_{t-1} and T are significant at the 1- and 10-percent levels respectively.

Efforts to include variables of price and weather conditions (temperature during fruit set and winter chilling measures) proved unsuccessful.

Utilization

Combining Equations (1) through (4) with an estimate of removals allows an estimate of total California production. This production goes into two main uses--processing for table olives and crushing for olive oil.

There are several types of processed table olives. They include: ripe, green ripe, chopped, sliced, halved, Sicilian, Greek, Spanish green (both stuffed and pitted), and dried. The two main types are the "California style" ripe and green ripe olives. The same definition will be used here as was introduced by Sammet and Sitton [18, p. 4] where "Canned refers to ripe and 'green ripe' olives." This definition excludes other table olives, but conforms with statistical information available on relative use of the olive crop.

The quantity of olives used for canning is termed the "canned pack" of olives. The pack has continued to increase its share of the total market

over time. In recent years, olives used for crushing have evolved to a by-product. "Thus olive oil production in California is largely a salvage operation, utilizing small, cull, or frozen fruits." [15, p. 5] "Other" uses have remained relatively constant over time.

The percentage of California production that is used for canning in any given season can be estimated by the equation

$$X_t = \underset{}{.32933} + \underset{(1.83)}{.00045}\ P_t - \underset{(-2.72)}{.00350}\ (Q_t + C_{t-1}) + \underset{(10.88)}{.37583}\ \text{Log}\ T \qquad (5)$$

$$R^2 = .8981 \qquad \text{S.E.} = .0535$$

where

X_t = percentage of total California production used for canning;

P_t = farm price per ton of olives used for canning deflated by the Wholesale Price Index (1957-1959 = 100);

Q_t = California production of olives (1,000 tons);

C_{t-1} = previous year's carry-over of canned olives (1,000 tons); and

T = time trend, where 1947 = 1, 1948 = 2, . . ., 1968 = 22.

The numbers in parentheses indicate t-ratios for the regression coefficients. P_t is significantly different from zero at the 10-percent confidence interval while the remaining coefficients are significant at the 5-percent level. R^2, the coefficient of determination, indicates nearly 90 percent of the variation in percentage canned is explained by variation in the three independent variables.

Pack

Given Equation (5) and a value of California production, canned pack can be estimated by the simple expression

$$PK_t = (Q_t)\ (X_t) \qquad (6)$$

where

PK_t = canned pack of olives (1,000 tons),

Q_t = California total olive production (1,000 tons), and

X_t = percent of total California olives used for canning.

Carry-over

Carry-over is the amount of unsold olives held by processors at the beginning of the harvest season. The quantity of carry-over in a given season is described by

$$C_t = C_{t-1} + PK_t - SP_{t-1} \qquad (7)$$

where

C_t = carry-over of canned olives at the beginning of harvest season (1,000 tons),

C_{t-1} = carry-over of canned olives at the beginning of the previous harvest season (1,000 tons),

PK_t = pack of canned olives in the previous year (1,000 tons), and

SP_{t-1} = sales and orders of canned olives in the previous year (1,000 tons).

When unfilled orders exceed stocks, a negative carry-over exists.

When no data on sales and orders of olives are available, carry-over can be estimated by a similar function with an additional variable, where

$$C_t = \underset{}{-5.7636} + \underset{(8.71)}{.46588}\ (C_{t-1} + PK_{t-1}) - \underset{(-3.25)}{.24623}\ T \qquad (8)$$

$$R^2 = .8546 \qquad \text{S.E.} = 1.6518$$

where

T = time trend, where 1947 = 1, 1948 = 2, . . ., 1968 = 22.

Both independent variables are significant at the 1-percent significance level.

Other factors that influence the size of carry-over include government purchases of olives and inventory procedures of firms in the marketing system. Sufficient data do not exist on these subjects to enable a quantitative adjustment to Equation (8); however, their influence is important enough to deserve additional comment.

In 1964 and 1965 the Federal Government purchased over 4,700 tons of canned ripe olives under provisions of the Federal School Lunch Program. Since these purchases were outside the normal marketing channels, they reduced carry-over stocks below "natural" levels. Federal purchases of this

type are generally limited to surplus commodities; therefore, its future influence will probably be limited to years of oversupply and low prices in the industry.

A second factor is the inventory practices at the various levels of the market system. Since there is a cost of storing canned olives (in terms of direct warehousing costs, financial costs for holding, and possible price risks), many retailers and jobbers prefer this function to be performed by processors. If the demand for this service increases, higher carry-over levels can probably be expected if all other variables are held constant.

Imports

In 1966, 49 percent of all olives consumed in the United States were imported. Table III-2 shows the 1966 percentage distribution of total market sales by source and type of olive. Spanish type olives are green pitted olives that are usually stuffed with pimentos, onions, or similar products. Retail sales of the Spanish type olives are usually packed in glass containers--either place packed by hand or thrown packed by machines. The hand packed olives command a higher price than similar olives packed by machines.

Spanish type olives have traditionally been imported in bulk containers and repacked by American food processors. However, this practice is rapidly changing. According to a committee of the United States Trade Commission: "The pattern of bulk imports has persisted for more than one-half a century; during the last quarter of 1965-1966, however, imports in retail containers, principally of glass, increased significantly." [25, p. 2]. The Tariff Commission reports that retail containers are place packed, and the price of the retail type imports is 8 to 18 percent lower than comparable domestic olives.

Over 95 percent of the foreign table olives are imported from Spain. The Spanish government maintains rigid quality standards on their exported olive products. The olive industry is one of Spain's largest industries, and the government uses tax, credit, and investment incentives to develop the processing portion of it.

Table III-3 shows the tariff schedule for imported olive products. These rates have been basically the same for the past 20 years. Members of

TABLE III-2

Sales of Olives in the United States in 1966

Source and type of olives	Total U.S. sales
	percent
Imported	
Spanish style	45.0
Other	4.0
Domestic	
Black ripe whole olives	27.5
Black ripe pitted olives	19.9
Green ripe olives	1.5
Chopped, sliced, and other	2.1
Total	100.0

Source: U.S. Tariff Commission [25].

TABLE III-3

Tariff Rates for Imported Table Olives, 1967

Description	Unit rate	Ad valorem equivalent
	dollars per gallon	percent of value
Pitted and stuffed olives	.30	15.0
Whole olives		
Ripe, in airtight containers	.30	16.0
Ripe, not in airtight containers	.15	8.0
Not ripe, in airtight containers	.20	17.0
Not ripe, not in airtight containers	.15	8.0

Source: California Olive Association [4].

the California olive industry and domestic packers of imported olives are currently seeking legislation to increase these tariff rates. The proposed legislation seeks a 50-percent ad valorem duty on imported olives packed in retail-size containers. This rate is considerably above the current 15- to 16-percent levels. This proposed legislation comes as a reaction to increased imports of the retail-size containers.

The quantity of table olives imported into the United States can be estimated by the expression

$$I_t = 24.3699 + \underset{(1.99)}{.00292}\, S_{t-1} + \underset{(2.11)}{.01065}\, P_{t-1} + \underset{(2.58)}{8.8282}\, \text{Log } T \qquad (9)$$

$$R^2 = .6410 \qquad \text{S.E.} = 3.9078$$

where

I_t = imports of table olives for year ending June 30 (1,000 tons);

S_{t-1} = total olive production in Spain for previous year (1,000 tons);

P_{t-1} = California farm price per ton of canning olives deflated by the Wholesale Price Index (1957-1959 = 100); and

T = time trend, where 1947 = 1, 1948 = 2, . . ., 1968 = 23.

The t-ratios in parentheses indicate all regression coefficients are significant at the 10-percent level.

Increases in tariff schedules could be expected to change the above relationship. These increases would decrease profitability of importing olives and economic theory suggests this would reduce quantities imported.

IV. PRICE DETERMINANTS

Part III outlined the components of olive supply in the United States and California. This section examines how this supply combines with other variables to determine farm prices.

Table IV-1 shows farm prices received from 1947 to 1968. Both prices received for canning and for all uses are presented. These prices are deflated to a 1966 constant-dollar basis by the Wholesale Price Index. Actual and deflated prices received by processors for canned olives are indicated for the years where data are available.

TABLE IV-1

Actual and Deflated Olive Prices, 1947 to 1968

Year	Actual canning price[a]	Actual price all use[a]	Actual canned price received by processors[b]	Wholesale price index 1957-1959 = 100[c]	Deflated canning price[d]	Deflated price all use[d]	Deflated canned price received by processors[d]
	dollars per ton						
1947	186	150	--[e]	81.2	243	196	--
1948	224	145	--	87.9	270	175	--
1949	258	190	--	83.5	327	241	--
1950	305	231	--	86.8	372	282	--
1951	262	173	--	96.7	287	189	--
1952	150	103	--	94.0	169	116	--
1953	267	198	--	92.7	305	226	--
1954	226	166	--	92.9	258	189	--
1955	290	242	--	93.2	330	275	--
1956	247	178	--	96.2	272	196	--
1957	296	236	--	99.0	317	252	--
1958	144	101	--	100.4	152	106	--
1959	276	229	--	100.6	290	241	--
1960	203	157	--	100.7	214	165	--
1961	217	160	--	100.3	229	169	--
1962	262	214	804	100.6	276	225	846
1963	245	193	871	100.3	259	203	919
1964	165	135	757	100.5	174	142	798
1965	253	216	828	102.5	261	223	855
1966	278	231	896	105.6	278	231	896
1967	454	374	1,050	106.1	453	373	1,048
1968	350[f]	333[f]	--	--	--	--	--

a/ California Department of Agriculture, Crop and Livestock Reporting Service [3].

b/ Unpublished information made available by industry officials; prices f.o.b. processor plant in California.

c/ U.S. Department of Agriculture [22].

d/ All prices deflated to 1966 dollar terms.

e/ Dash indicates data not available.

f/ Preliminary.

Derived Demand

The demand for olives at the farm level is a derived demand. Consumers demand olives in a processed form at a retail outlet. Retailers, in turn, demand olives from processors or wholesale agents. The processor's need for olives creates the demand at the farm level.

Figure IV-1 illustrates the derived demand concept for simplified demand curves and a fixed supply. The derived nature of demand points out how farm prices can be influenced by forces removed from the production process.

Processor Margins

The difference in prices at the various marketing levels shown in Figure IV-1 can be explained by marketing costs and margins. Using data for processor and farm prices gives an estimate of the processor-farm margin for canning olives which can be stated by the equation

$$PW_t = 642.8658 + \underset{(2.81)}{.8841}\ P_t \qquad (10)$$

$$R^2 = .8230 \qquad S.E. = 85.17$$

where

PW_t = canned olive price per ton received by processors deflated by the Wholesale Price Index (1957-1959 = 100) and

P_t = farm price per ton of olives used for canning deflated by the Wholesale Price Index (1957-1959 = 100).

Although Equation (10) is determined with only six observations, it can give a rough estimate of processor price margins. The t-ratio in parentheses indicates significance for the independent variable at the 5-percent level. The fitting of a time trend to price margins indicated no significant time trend in processor-farm margins.

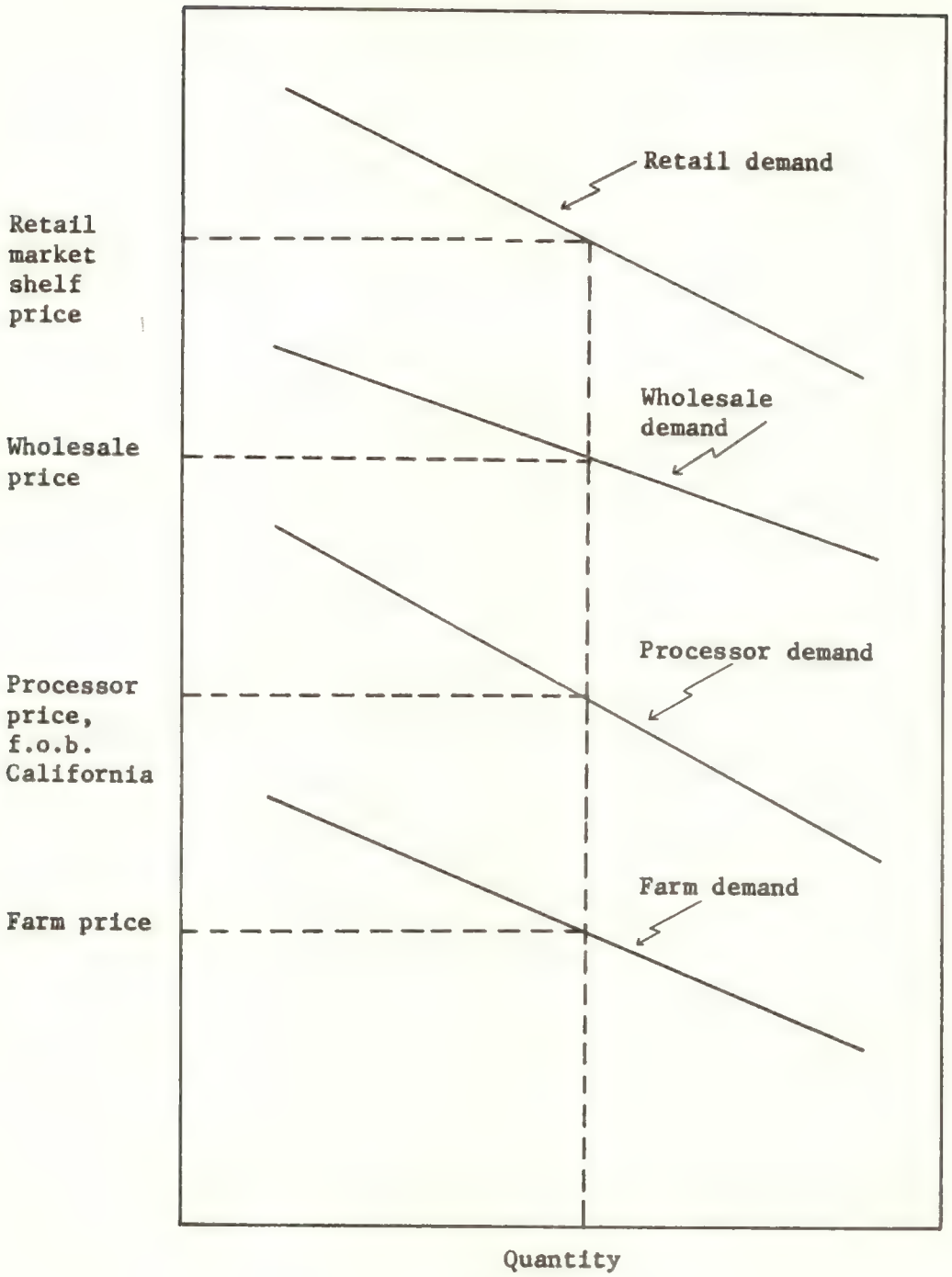
Unfortunately, information on prices and margins at other levels of the market system is not available. Without this data, estimates of farm demand must be made without consideration of marketing costs and margins.

Demand Estimates

Price determinants of a commodity that are implied by economic theory include: the supply of the commodity; the supply of competing or substitute

FIGURE IV-1

The Concept of Derived Demand



products; and the number, tastes, and disposable income of consumers. These variables were used to estimate price equations for the average farm price of canning olives and the average farm price of all uses of olives.

The price of olives used for canning can be estimated by the function

$$P_t = \underset{}{443.496} - \underset{(-6.52)}{3.3431}\, Q_t - \underset{(-4.46)}{10.7383}\, C_t - \underset{(-1.89)}{3.2691}\, I_t + \underset{(3.73)}{1.7420}\, Y_t - \underset{(-1.90)}{.0727}\, T \qquad (11)$$

$$R^2 = .8230 \qquad \text{S.E.} = 33.36$$

where

P_t = farm price per ton of olives used for canning deflated by the Wholesale Price Index (1957-1959 = 100);

Q_t = California production of olives (1,000 tons);

C_t = carry-over of canned olives from the previous season (1,000 tons);

I_t = imports of table olives for year ending June 30 (1,000 tons);

Y_t = index of per capita consumer real disposable income (1957-1959 = 100); and

T = time trend, where 1947 = 1, 1948 = 2, . . ., 1967 = 21.

Tests of significance of the t-ratios indicate I_t and T are significantly different from zero at a 10-percent confidence level, while the remaining independent variable coefficients are significant at the 1-percent level. Equation (11) states that price varies inversely with quantity and directly with income. The time trend variable serves as a proxy for changes in population and consumer tastes.

The average farm price for all uses of olives can be estimated by the equation

$$P'_t = \underset{}{338.59} - \underset{(-7.46)}{3.5042}\, Q_t - \underset{(-3.66)}{7.9802}\, C_t - \underset{(-1.87)}{2.5819}\, I_t + \underset{(4.79)}{1.8207}\, Y_t \qquad (12)$$

$$R^2 = .8385 \qquad \text{S.E.} = 30.63$$

where

P'_t = farm price per ton of all olives deflated by the Wholesale Price Index (1957-1959 = 100),

Q_t = California production of olives (1,000 tons),

C_t = carry-over of canned olives from the previous season (1,000 tons),

I_t = imports of table olives for year ending June 30 (1,000 tons), and

Y_t = index of per capita consumer real disposable income (1957-1959 = 100).

The t-ratios indicate I_t is significant at the 10-percent level while other coefficients are significant at the 1-percent level. Other variables considered for Equation (12) were a time trend and percent of quantity used for canning. The coefficients for these variables were found insignificant.

Additional Modifiers of Price

Besides the variables included in Equations (11) and (12), there are several other factors that can act to modify prices. Three of these factors will be discussed. They are: advertising and promotion of table olives, export market development, and regional distribution of domestic olive sales.

Promotion

California olives are advertised and promoted on both the retail and trade levels. Advertising for the entire industry is funded by marketing orders governing olives. More far-reaching advertising is done by individual processing firms.

The industry-wide promotion is general in scope, stressing all forms of California olives with no brand identification. Processor advertising emphasizes individual brand identification and differentiation. Both types of promotion methods are conservative in approach and limited in use by the industry.

No analysis is attempted to determine the effectiveness of present promotion or the implications of more extensive advertising. Advertising exists as a tool that can possibly cause increases in consumer demand if used effectively.

Export Markets

The export of canned olives has been insignificant in recent years. The quantity exported ranges from 1,000 to 1,500 tons per year [13]. About two-thirds of this total goes to markets in Canada and Mexico.

Any increase in the export market is dependent upon the competition from table olives produced in other parts of the world. The relatively high cost of California olives as compared to olives from other sources is a serious limiting factor in the expansion of this market. Product differentiation and quality competition appear as possible means of fighting this problem.

Many industry leaders have an optimistic view toward the Japanese export market for olives. They predict that, with proper development, this market will be able to support a sizable share of the total California production of table olives. Development of new export markets could be expected to have a positive influence upon olive prices.

Domestic Consumption

Table IV-2 shows shipments of California canned olives by states for 1966. The table further shows estimated per capita California canned olive consumption and per capita income for 1966. The shipment distribution for 1966 is representative of recent years. Shipment figures for certain Western states are slightly higher than actual sales due to some reshipment of the canned stocks.

The top nine states listed in Table IV-2 account for over two-thirds of total California canned olive shipments. More intensive development of table olive marketing in the remaining states could have a positive influence upon farm prices. Industry leaders cite the inability to keep new markets supplied as the major factor in failing to develop them. They feel these "underdeveloped" market areas represent a means of disposing of any increases in canned olive supplies over time.

V. APPLICATIONS

The functional relationships developed in the previous sections can provide tools by which to analyze different questions and problems within the

TABLE IV-2

Regional Distribution and Consumption of California Canned Olives in 1966

State	Shipments[a/]	Total shipments	Per capita consumption	Per capita income[b/]
	1,000 tons	percent	pounds per person	dollars per person
California	10.373	29.08	.541	3,394
New York	3.856	10.81	.210	3,472
Illinois	2.526	7.08	.232	3,492
Pennsylvania	1.737	4.87	.150	2,963
New Jersey	1.509	4.23	.215	3,389
Ohio	1.288	3.61	.123	3,028
Massachusetts	1.281	3.59	.237	3,277
Michigan	1.220	3.42	.142	3,224
Washington	1.145	3.21	.371	3,177
Oregon	0.952	2.67	.476	2,877
Texas	0.927	2.60	.085	2,516
Florida	0.781	2.19	.130	2,565
Wisconsin	0.532	1.49	.127	2,946
Minnesota	0.506	1.42	.141	2,901
Utah	0.506	1.42	.492	2,429
Connecticut	0.492	1.38	.168	3,627
Maryland	0.487	1.37	.108	3,282
Missouri	0.460	1.29	.100	2,783
Colorado	0.446	1.25	.225	2,875
Arizona	0.339	0.95	.206	2,545
Indiana	0.339	0.95	.068	3,038
Rhode Island	0.289	0.81	.318	3,000
Hawaii	0.289	0.81	.395	3,019
Nebraska	0.221	0.62	.153	2,894
Kansas	0.203	0.57	.090	2,857
Iowa	0.193	0.54	.070	2,996
Montana	0.178	0.50	.257	2,687
Idaho	0.171	0.48	.247	2,427
Oklahoma	0.164	0.46	.066	2,446
Nevada	0.149	0.42	.342	3,471
Tennessee	0.139	0.39	.036	2,215
Louisiana	0.093	0.26	.047	2,016
Maine	0.093	0.26	.096	2,515
Virginia	0.089	0.25	.020	2,575
Alabama	0.089	0.25	.025	2,049
Georgia	0.089	0.25	.020	2,340
North Dakota	0.086	0.24	.136	2,385
New Hampshire	0.082	0.23	.118	2,774
New Mexico	0.068	0.19	.067	2,358
Kentucky	0.050	0.14	.016	2,241
North Carolina	0.043	0.12	.011	2,173
South Carolina	0.043	0.12	.011	2,173
Arkansas	0.039	0.11	.011	2,251
Wyoming	0.039	0.11	.123	2,753
South Dakota	0.032	0.09	.048	2,407
West Virginia	0.028	0.08	.016	2,194
Alaska	0.028	0.08	.101	3,357
Mississippi	0.018	0.05	.008	1,775
Vermont	0.018	0.05	.043	2,524
Delaware	0.014	0.04	.027	3,501

a/ California Olive Association [4].

b/ Bretzfelder, Robert B., Q. Francis Dallavalle, and David A. Hirschberg [1].

olive industry. One interesting application is projecting future levels of price, acreage, and supply. This section makes three projections, each under different assumptions.

In Part I, Figure I-1 outlined an economic model to describe the California olive industry. Unfortunately, quantitative relationships cannot be attached to each of the elements in Figure I-1. Rather, the analytical model used in this section is composed of the elements outlined in Figure V-1. This represents the statistical model for the industry used in making projections. The numbers in parentheses in Figure V-1 indicate the appropriate equation for each variable.

The Statistical Model

From Figure V-1 prices of olives are determined by carry-over, imports, California production, and incomes. The prices received for all uses can be used to determine the grower's profit expectation--this enables calculation of new plantings.

New plantings are lagged by seven years and combined with removals to give estimates of bearing acreage. The bearing acreage is multiplied by yield per acre estimates to give California production.

The price received for canning is used with quantity to estimate the canned pack. The pack and previous carry-over are used to estimate the current carry-over. Finally, the farm price for canning is combined with estimates of Spanish production to calculate expected imports.

This simple process can be repeated continuously to project any of the variables within the model.

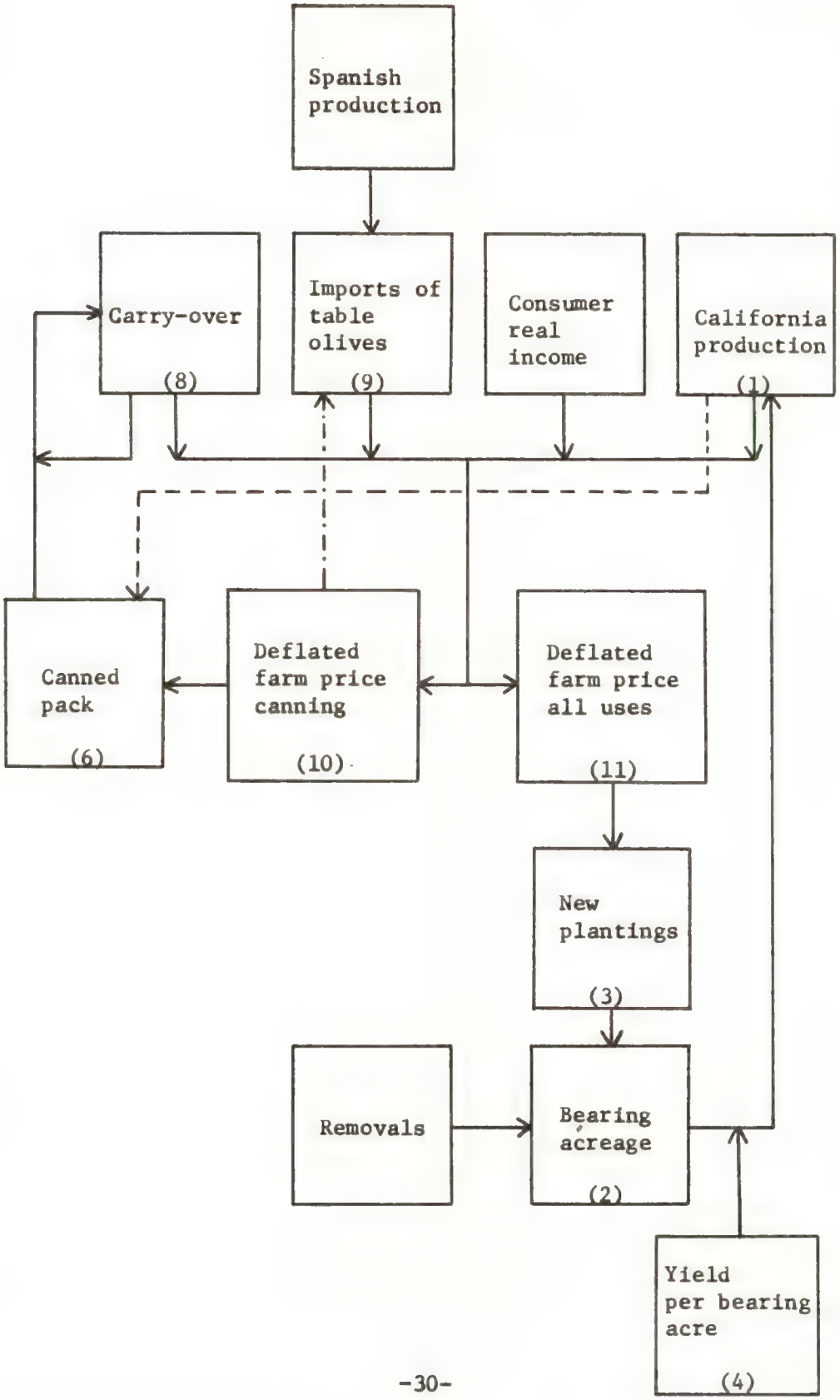
Projections

On the basis of the above model, three projections of price, acreage, and California production are made. The first projection analyzes these variables within the existing framework of the industry. The later two projections analyze the effects of changes in the import pattern of table olives.

Projection 1: Removal of olive trees is assumed to be 1.8 percent of the bearing acreage. Spanish production of olives is assumed to be a constant

FIGURE V-1

A Statistical Model of the California Olive Industry



1.8 million tons per year. Per capita real income is increased 3.6 percent per year.

Projection 2: The assumptions used in Projection 1 are kept. Imports of table olives are assumed to increase at the rate of 1,000 tons per year.

Projection 3: Imports are assumed to hold a constant rate of 25,000 tons per year. This is used to represent the situation of an import quota or higher ad valorem tariffs on table olives. The remaining assumptions are the same as Projection 1.

Interpretation

Figure V-2 plots projected olive acreage to 1980. All three projections produce the same acreage estimates until the late 1970's due to the fixed nature of new bearing acreage for prior years. After 1978 bearing acreage increases more rapidly under Projection 3 due to higher prices received with import restrictions. The opposite situation is experienced with Projection 2 as lower prices experienced with more import competition reduce the grower incentives to plant. Acreage projections are combined with yield estimates to project California supply (Figure V-3).

The price differentials mentioned above are shown in Figure V-4 and Figure V-5. These diagrams show projected prices for all uses and for canning. The gradual increase in imports assumed in Projection 2 causes a gradual increase in the price differentials between Projections 1 and 2. The restricted import situation of Projection 3 causes an immediate increase in prices over Projection 1.

The projected price levels for all cases are considerably above prices received in the last decade. This results primarily from fewer bearing acres of olive trees during the 1970's versus the 1960's.

FIGURE V-2

Projected Olive Bearing Acreage

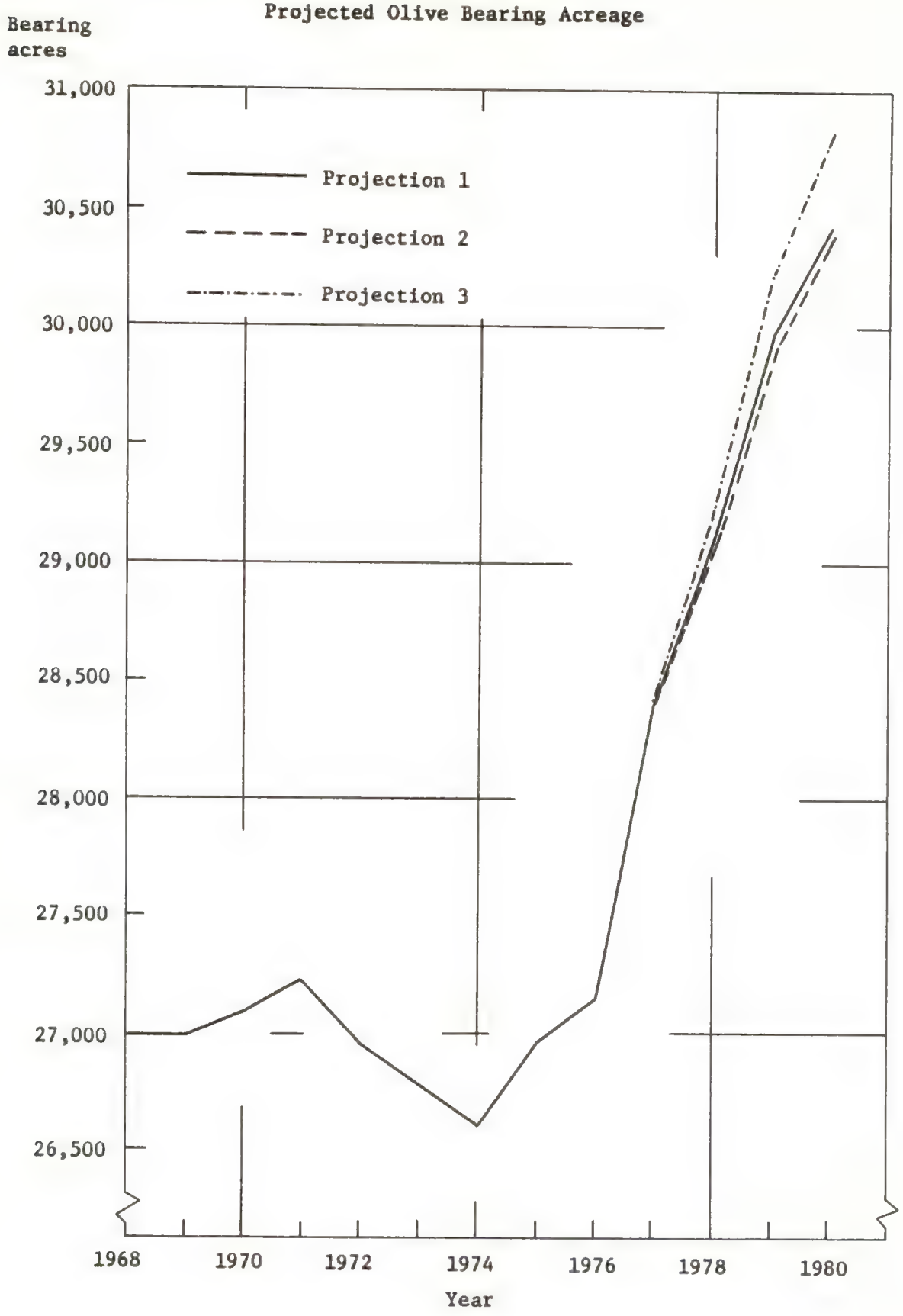


FIGURE V-3

Projected California Olive Production

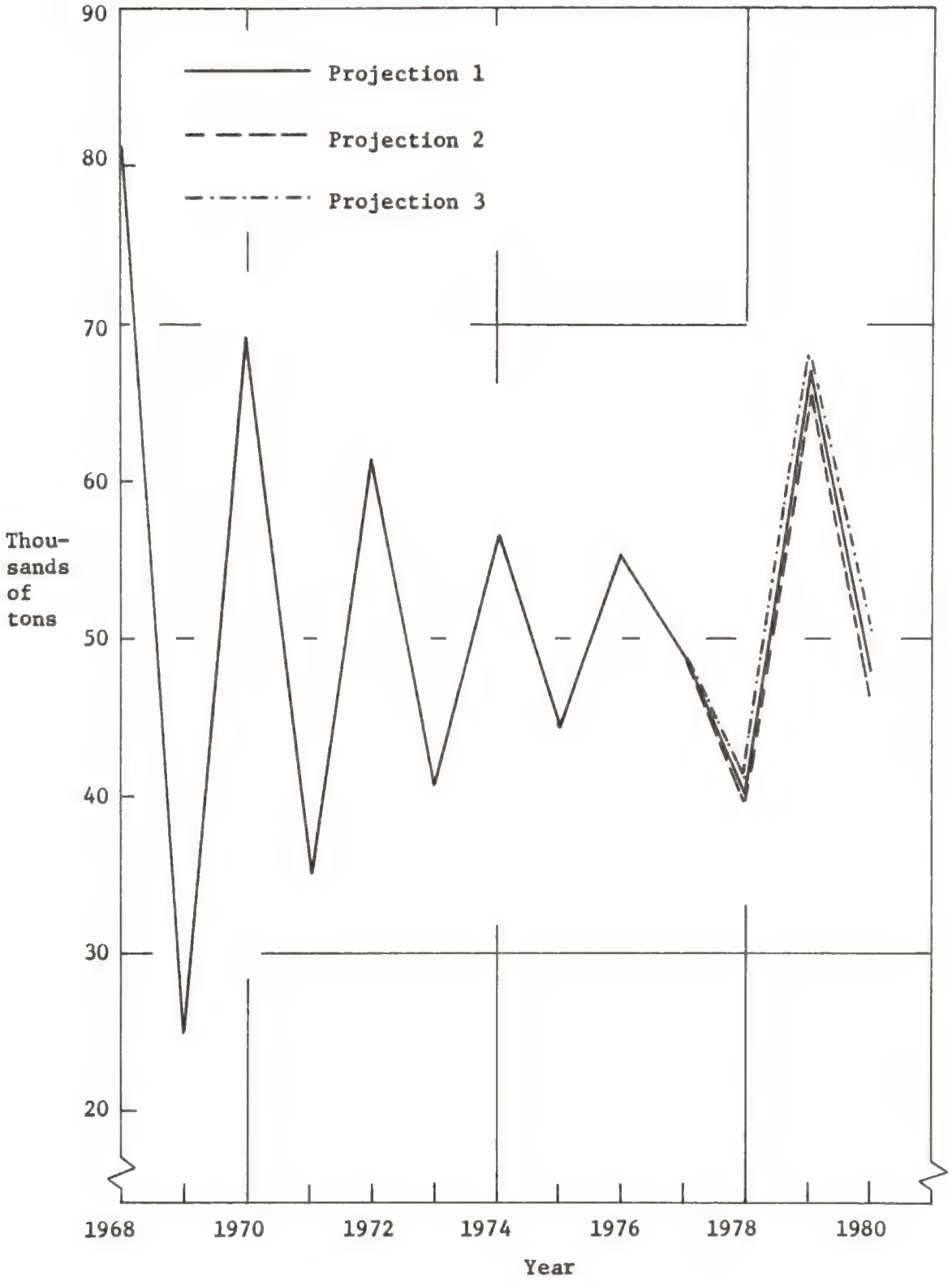


FIGURE V-4

Projected Average Olive Farm Price for All Uses

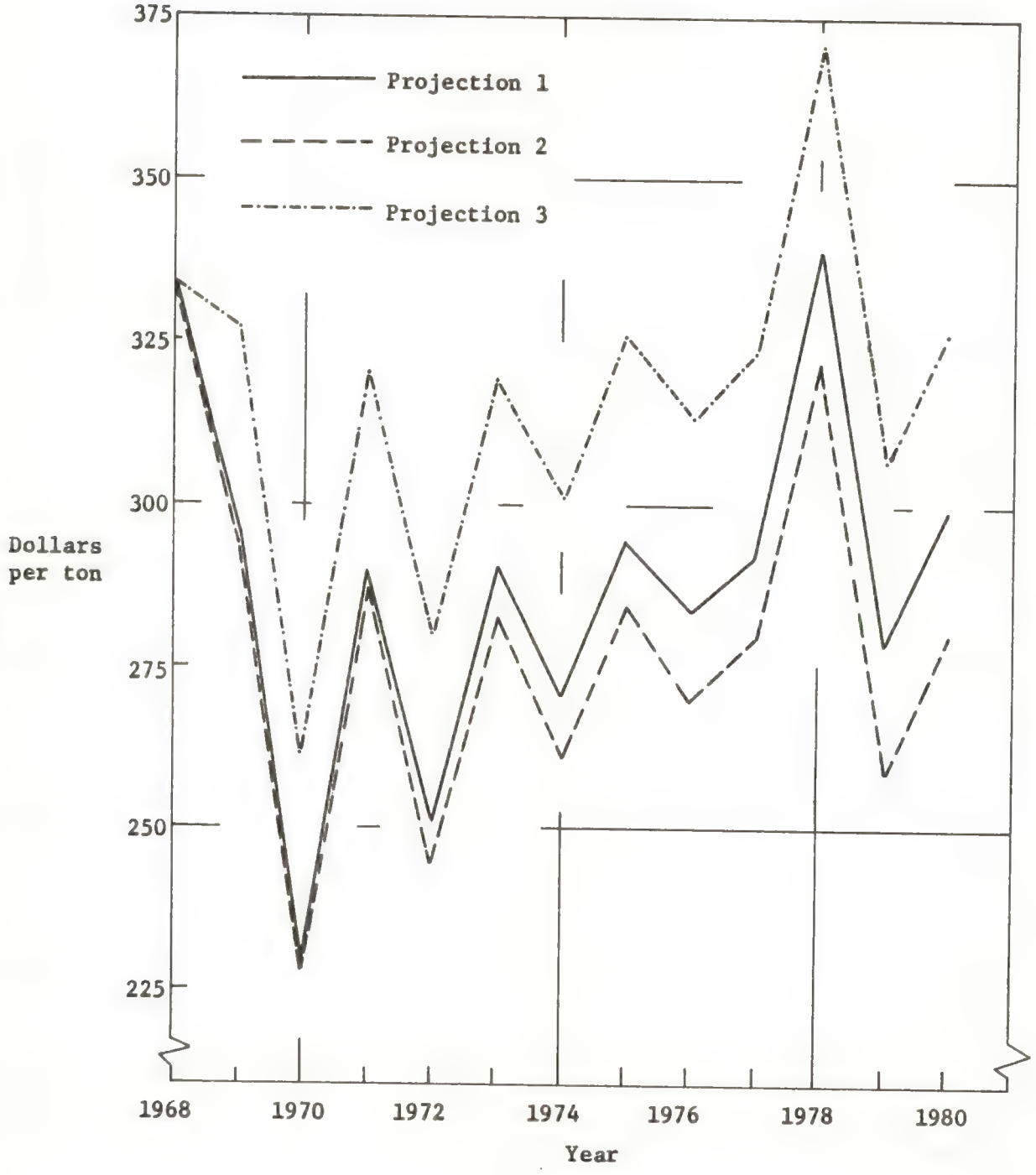
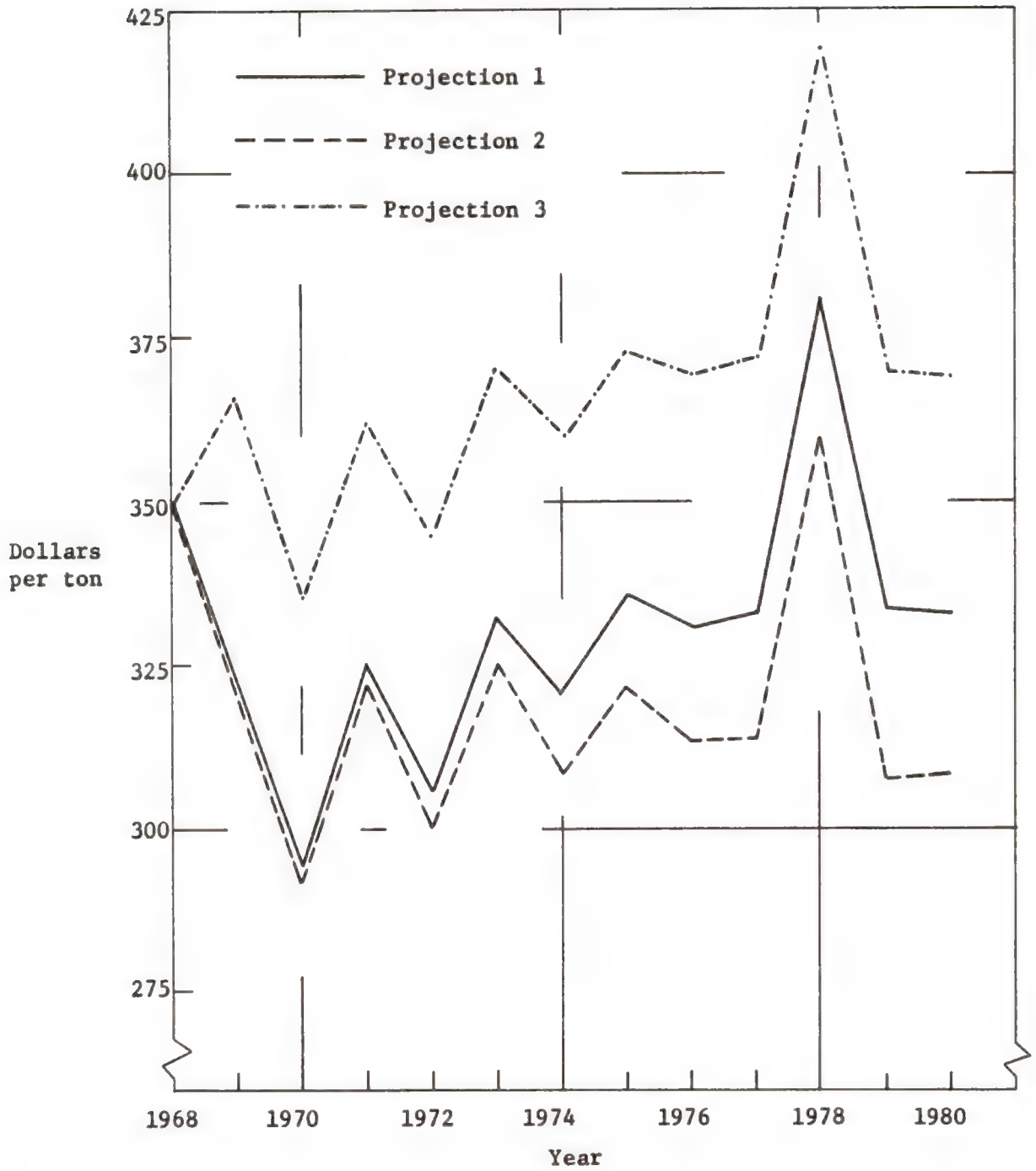


FIGURE V-5

Projected Farm Price of Olives Used for Canning



SUMMARY

The statistical model used to make the above projections is a simplified representation of the entire industry. It predicts what will happen in the industry on the basis of what has happened in the past. It excludes any major shifts or changes in the manner variables are determined. It also excludes variables that are not presented in the functional relationships. These factors should be understood when analyzing the projected results.

APPENDIX A

TABLE A-1

Olive Costs of Production: San Joaquin Valley

Item	Year			
	1947	1955	1964	1967
	dollars per acre			
Pruning	15.00	15.50	55.50	67.50
Weed Control	9.50	13.00	22.50	25.90
Pest control				
Labor	7.50	35.00	30.00	30.00
Material	15.00	55.44	18.00	18.00
Fertilizer				
Labor	1.00	1.50	2.70	3.00
Material	10.00	17.20	4.80	4.50
Irrigation				
Labor	10.00	5.00	15.60	19.20
Water	15.00	24.75	18.00	22.50
County taxes	10.00	15.00	25.00	35.00
Other costs	--a/	18.20	36.40	36.00
Total per acre preharvest cost	93.00	180.59	212.60	261.60
Harvest cost per ton	53.00	85.00	90.50	90.00

a/ Data not available.

Source: U.S. Department of Agriculture [23].

TABLE A-2

Cost Per Acre to Develop an Olive Orchard:
San Joaquin Valley, 1967

Item	Year								
	1	2	3	4	5	6	7	8	9
	dollars								
Prepare land	11	--a/	--	--	--	--	--	--	--
Plant	12	--	--	--	--	--	--	--	--
Tree cost	50	--	--	--	--	--	--	--	--
Pruning	--	--	--	--	--	30	45	68	68
Fertilize	2	3	4	6	7	8	8	8	8
Pest control	--	--	--	7	10	20	34	48	48
Weed control	12	12	12	12	12	12	12	12	12
Irrigation	24	28	30	32	35	42	42	42	42
Other cultural	10	10	10	14	16	20	20	20	20
Taxes	20	20	20	20	27	36	36	36	36
Depreciation	26	23	23	23	22	21	21	21	21
Interest	72	85	95	104	113	117	120	121	122
Other overhead	7	4	6	8	11	30	30	29	30
Harvest cost	--	18	36	72	143	238	291	327	363
Total cost per acre	246	203	235	299	397	574	659	732	770

Investment	
Land	1,000
Trees	73
Irrigation system	200
Buildings	190

a/ Dash indicates data not available.

Source: Sibbett and Burlingame [20].

TABLE A-3

Olive Processing Costs, 1961 Pack

Item	Cost per case 24 #1 tall cans large	Cost per ton
	dollars	
Labor, cannery, and warehouse	0.621	86.94
Cannery operations	0.111	15.54
Warehouse delivery	0.154	21.56
Packages	1.069	149.66
Fruit cost	1.852	259.28
Cannery burden	.344	48.16
Cost to pack	4.151	581.14
Brokerage fees	0.348	48.72
Discounts and allowances	0.403	56.42
Overhead	0.563	78.82
Total cost to pack and sell	5.465	765.10

Source: Foytik [13].

APPENDIX B

TABLE B-1

Olive Acreage, Yields, and Production, 1947 to 1968

Year	New plantings	Nonbearing acreage	Bearing acreage	Yield per bearing acre	Total California production
	acres			tons	1,000 tons
1947	955	4,866	27,661	1.45	39.8
1948	588	5,223	27,485	2.11	57.8
1949	417	5,156	27,566	1.27	34.8
1950	719	5,245	27,432	1.53	41.8
1951	433	4,898	27,795	2.30	63.8
1952	431	4,238	27,514	2.07	56.8
1953	197	3,715	27,445	1.02	27.8
1954	101	2,895	28,163	1.78	49.8
1955	512	2,466	28,743	1.25	35.8
1956	568	3,155	27,707	2.53	69.8
1957	985	3,156	27,859	1.33	36.8
1958	809	3,121	28,556	2.38	65.8
1959	735	4,043	28,171	0.96	26.8
1960	754	3,821	28,277	2.33	65.8
1961	400	4,086	28,164	1.56	43.8
1962	561	3,919	28,291	1.84	51.8
1963	636	4,538	28,361	2.01	56.8
1964	199	3,663	28,606	1.89	53.8
1965	338	3,190	27,690	1.81	49.8
1966	310	2,700	26,600	2.37	62.8
1967	830	2,880[b]	27,040[b]	0.44[b]	12.0[b]
1968	--[a]	3,440[b]	27,000[b]	3.00[b]	81.0[b]

a/ Data not available.

b/ Preliminary.

Source: California Department of Agriculture, Crop and Livestock Reporting Service [3].

TABLE B-2

California Canned Olive Pack, Supply, Shipments, and Carry-over, 1940-1941 to 1966-1967

Season[a]	Carry-over	Pack	Supply	Shipments
	1,000 tons			
1940-1941	1.8	16.2	18.0	16.9
1941-1942	1.1	16.7	17.8	16.1
1942-1943	1.7	10.7	12.4	12.4
1943-1944	--[b]	15.4	15.5	15.2
1944-1945	.2	13.7	13.9	13.8
1945-1946	.1	13.3	13.5	14.7
1946-1947	- 1.2	27.2	26.0	19.5
1947-1948	6.6	13.7	20.3	16.8
1948-1949	3.4	13.4	16.8	17.0
1949-1950	- .2	19.9	19.7	20.1
1950-1951	- .4	25.1	24.7	22.6
1951-1952	2.1	31.8	33.9	24.4
1952-1953	9.6	24.9	34.5	28.6
1953-1954	5.8	18.3	24.1	22.6
1954-1955	1.5	29.2	30.7	28.1
1955-1956	2.6	26.7	29.3	27.5
1956-1957	1.8	37.0	38.8	29.8
1957-1958	9.0	27.1	36.1	28.3
1958-1959	7.8	31.6	39.4	30.1
1959-1960	9.3	23.0	32.3	28.5
1960-1961	3.8	41.0	44.8	34.8
1961-1962	10.0	28.9	38.9	32.2
1962-1963	6.7	35.6	42.3	31.4
1963-1964	10.8	40.3	51.2	38.1
1964-1965	13.1	35.8	48.9	43.6
1965-1966	5.4	36.6	41.9	38.1
1966-1967	3.8	42.0	45.8	35.7
1967-1968	10.0	10.6	20.6	--[b]

a/ Canning season, December 1 to November 30.

b/ Not available.

Source: California Olive Association [4].

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